

AN EMPUSA ON A MITE.

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(Communicated by Dr. A. J. Nicholson.)

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In C.S.I.R. Pamphlet No. 84, "A population study of the red-legged earth mite (*Halotydeus destructor*) in Western Australia", etc.,* the author, Mr. K. R. Norris, recorded the occurrence of a fungus, a species of *Empusa*, on that pest. Subsequently, Mr. Norris kindly sent me specimens of diseased mites, and from these it was possible to confirm his identification. The field observations recorded below have been taken from Mr. Norris's data.

The mite normally has a jet-black body and red legs. When attacked by the fungus, the whole of the dorsal surface and the sides of the body are coloured yellowish-brown, and this area is sharply demarcated from the black ventral surface. Thus it is possible to pick out diseased mites in the field. Mr. Norris found that the change of colour was due to the presence immediately below the cuticle of a mass of hyphal bodies.

Individuals of *Halotydeus destructor*, killed by this *Empusa*, are attached to the host plant by their mouth parts, or are entangled in the tomentum of the leaf. There are no rhizoids. The conidiophores are short, stout and unbranched. The primary conidia are oval, $9-12 \times 5-7\mu$, or subglobose, $8 \times 6\mu$, in each case with a broad, truncato-convex papilla. The secondary conidia are similar, and are borne on a stout germ tube from any part of the primary conidium, but usually laterally, in the same manner as in *Entomophthora Aphidis*. As far as I am aware, no *Empusa* has been recorded previously on Acarina, and the present species does not agree with any known form. It is apparently a new species, which I name *Empusa acaricida*.

EMPUSA ACARICIDA Petch, n. sp.

Conidiophoris brevibus, crassis, simplicibus; conidiis primariis ovalibus, $9-12 \times 5-7\mu$, vel subglobois, $8 \times 6\mu$, conidiis secundariis similibus, papilla lata, truncato-convexa; hyphis rhizoideis nullis. On the earth mite, *Halotydeus destructor* (Acarina), Western Australia.

Changes of colour in insects attacked by species of Entomophthoraceae have rarely been recorded. Thaxter, in his *Entomophthoraceae of the United States*, stated, concerning *Entomophthora Aphidis* (p. 177): "The conidiophores are white in the mass, often tinged with yellowish or flesh color from the coloring matter of the host, which usually assumes a pale brick red tint at or just before death. This change of color is, however, common to most aphides attacked by Empusae, and cannot be considered distinctive of any species." I have not observed that change of colour regularly in the numerous examples of these fungi on aphids which I have collected, except in the case of *Empusa Planchoniana* (Cornu) Petch.

* *H. destructor*, and no doubt also the *Empusa* which attacks it, has a very wide range in Australia, and occurs in many places in the Eastern States as well as in Western Australia.—Ed.

The latter species was described by Cornu from specimens on a black aphid, which was turned brick-red by the fungus. I have found it on a green aphid, on greengage, the insects again being turned red by the fungus; and Phillips described apparently the same species on *Aphis rumicis*, a black aphid, as *Entomophthora ferruginea*, the name being chosen because of the colour of the insect and the fungus. It would seem, therefore, that this colour change is usual in attacks of *Empusa Planchoniana* on aphids.

In flies, especially Syrphids, attacked by *Empusa Muscae*, the abdomen becomes enormously swollen, and appears white, with transverse black or grey lines. This colour, however, is a mechanical effect, due to the extension of the intersegmental membranes, so that the white internal fungus is seen through them.

How long the earth mite, *Halotydeus destructor*, can live after infection can only be determined by experiment, but Mr. Norris has furnished the following data bearing on the point:

One diseased mite collected 30th May died 3rd June
 One diseased mite collected 30th or 31st May died 4th June
 One diseased mite collected 31st May died 3rd June
 One diseased mite collected 31st May died 8th June
 Two diseased mites collected 1st June died 3rd June
 One diseased mite collected 15th June died 23rd June
 One diseased mite collected 15th June died 4th July

In all the foregoing instances, the dead mites produced conidia of the *Empusa*.

In general, insects attacked by Entomophthoraceae produce conidiophores and conidia shortly after death, unless dry weather conditions have set in, when the insect may dry up and a growth of *Cladosporium* or some allied fungus may supervene.

From the foregoing data, it appears that mites attacked by *Empusa acaricida* may be recognized by the change in their coloration at least nineteen days before they die. There is very little information on this point with regard to insects in general. Thaxter (*op. cit.*, p. 152) wrote, respecting Entomophthoraceae: "The period which ensues after the infection of a host until death varies to some extent. In the larger hosts, such as flies and caterpillars, death may not take place for twelve days; although the usual period is from five to eight days. In minute hosts, the period must be considerably shortened, owing to the ephemeral character of many of the forms known to be subject to the attack of Empusae."

The flies attacked by *Empusa Muscae*, noted above, in which the abdomen is abnormally swollen, are able to fly about until shortly before death, but it is not known how long they can retain their activity in that condition, as they have only been observed when they settled down for the last time, death ensuing in a few hours. With regard to fungi other than Entomophthoraceae, it may be recalled that Torrubia, who first described the "Vegetable Wasp", i.e. wasps attacked by *Cordyceps sphecocephala*, illustrated the insects flying about with the *Cordyceps* attached to them. That has been regarded as a traveller's tale, but a bee, bearing apparently the conidial stage of that fungus, has been caught flying about in England. The latter specimen is illustrated in Cooke's *Vegetable Wasps and Plant Worms*, fig. 12.

Although insects attacked by entomogenous fungi ultimately succumb to the attack of the parasite, it would appear from the few available records that they may continue their activities without being seriously incommoded for a longer period than would be expected.